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CONTENTS:

THE SIZE OF THE THYMUS GLAND IN RELATION TO THE SIZE AND DEVELOPMENT OF THE FŒTAL PIG AS STUDIED IN A VARIED RANGE OF STAGES,

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The Size of the Thymus Gland in Relation to the Size and Development of the Foetal Pig as Studied in a Varied Range of Stages.

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INTRODUCTION.

THE thymus gland has long been a favorite subject for study and for speculation as to its function and possible effect upon growth. Much work has been done in extirpation of the gland in postnatal animals in order to note the effect upon metabolism. Different results have been obtained as different species of animals were examined, depending largely upon the time of involution of the gland in that particular animal. H. Matti (1) found that extirpation of the thymus in pups (eighteen days to eight weeks in age) caused slowness of movement, muscular weakness, softness of bones, bone changes resembling those in rickets, and subsequent death. Almost similar results were reported by Basch (2). Such findings would seem to indicate a direct effect upon bone formation, and accordingly upon the size of the animal. That the size of thymus is correlated with size of animal (*i. e.*, in individuals below age of involution stage) is evidently accepted as probable by Badertscher (3), who states in a description of a sketch that "[above is an] outline drawing of the exposed left thymus of a 'runty' pig, one day old and only 240 mm. in length; the thymus in this specimen was a few millimeters shorter than that in the full-term embryo; this is perhaps due to the fact that the specimen was a 'runt.'" On the contrary, Hatai (4), in a study of postnatal rat thymi, states that "the weight of the thymus is correlated with the *age* of the rat rather than the body weight," thus showing a counter finding.

This problem, then, was deemed worthy of investigation, and for study the fœtal pig was chosen, largely because it shows the typical mammalian characteristics and because little work of any sort has been attempted with the fœtal pig; then, too, the material was fairly easily obtained and was found to be highly satisfactory. Since the pig had been selected, a further phase of the subject arose, and its importance became evident: as yet (as we believed after a search through literature) no one had studied the thymus in any great number of fœtal pigs and had tabulated measurements and thus secured normal averages and percentages. Such tables of averages, etc., we recognized to be of great value as a basis for further work in this direction or in any phase of thymus work in pigs. Extensive work of this sort has been done by Hatai (5) and by Jackson (6) in albino rats, and by others.

Therefore, it is with this twofold purpose that this paper is presented: (1) to give our findings as to the relation of the size of the thymus gland to the size of the fœtal pig, and (2) to furnish, as a possible basis for further research, tables of measurements and weights of many individual pig fœti of various sizes, with the measurements and weights of their thymi and individual and group averages. We hope to further continue the study to include postnatal pigs; in this study a further object of interest will be the determination of the time of the involution stage, since such time would be expected to lie in the postnatal period.

METHODS OF OBTAINING SPECIMENS AND LABORATORY TECHNIQUE USED.

Specimens were obtained from the plant of the Armour Packing Company in Kansas City, Kan. The collectors went on the killing floor of the plant, secured suitable uteri, removed the fœti, tied the umbilical cords, and put the pigs into a preservative solution (formaldehyde) ready for shipping. Litters were kept separate by means of cheesecloth bags for individual litters. Care was taken to get fœti of as wide a range of lengths as possible, varying from 9.5 to 28.5 centimeters.

In the laboratory each pig was weighed, its length recorded (head to rump measurement taken), and its sex determined; then each pig was given a litter letter and a serial number, and tagged so that future identification was possible. The remaining procedure in the actual bulk of the work was simple, and the dissection progressed rather rapidly once the technique was mastered, and an exact idea of the extent of the thymus was secured. The neck and upper

thoracic region of the body were stripped of skin, and the thymus beneath (easily seen) dissected away from the surrounding tissue. The gland was then washed, dried superficially on filter paper, and weighed. This process was carried out on almost 150 pigs, and tables and curves were made and studied to determine tendencies.

RELIABILITY OF RESULTS.

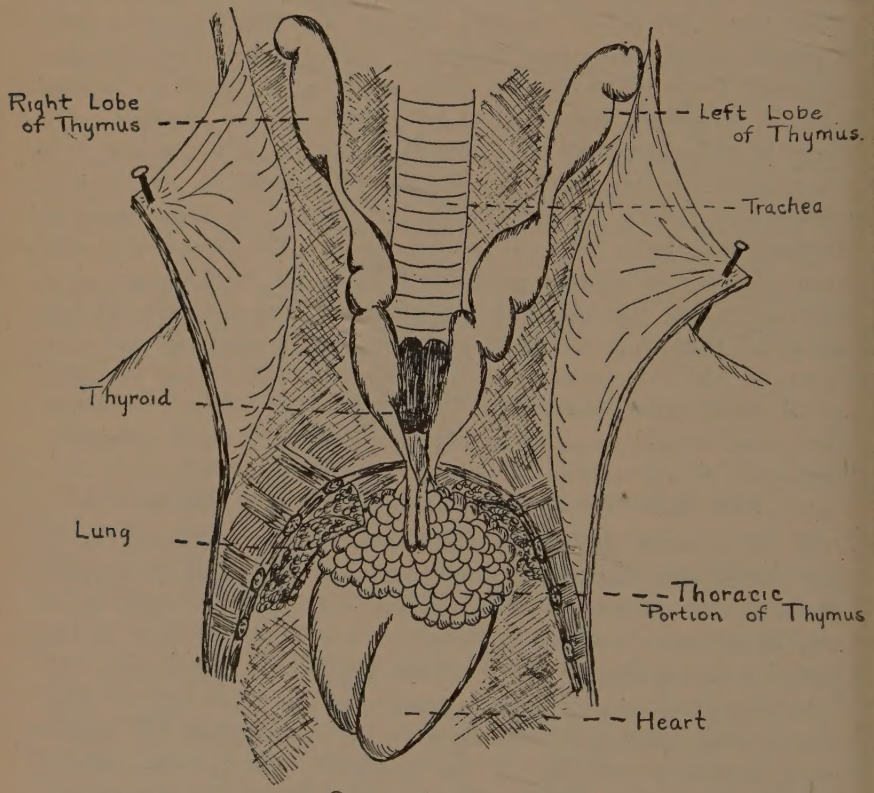
Before going into the body of the report it may be well to consider just how reliable were the results obtained, and wherein lay sources of error. (1) In the weighing of the pigs, some of them may have absorbed more of the formaldehyde preservative than others; some may have lost more of their body fluids than others. This error seems to us, however, as negligible. (2) The chemical balances used were not of the best, and, too, the thymi may not have received exactly the same treatment after removal from the pig, although every effort was put forth to secure uniformity. To this end, all weighings (practically) were made by one operator. (3) Lengths of the pigs may not be entirely accurate, although here, too, the greatest care possible was taken to secure exactness. (4) Lastly, incomplete removal of the thymus, or removal of other tissue as thymus, may have occurred in some cases. The greatness of this error depends, of course, upon the skill of the workers, and it is their hope that this has been a negligible factor of error. Taking all in all, then, it is extremely probable that the material and data to be set forth are accurate to this degree, that they may be taken as the basis for conclusions of a definite nature. Such conclusions are, in our minds, accurate and reliable enough to merit consideration.

THE THYMUS: ITS GENERAL SHAPE AND EXTENT.

It was not our purpose to study the structure of the thymus in any detail, and this part of the report is merely made in passing, without any attempt at thoroughness. Our findings seem to be similar in many respects to those of Badertscher (3) as to the anatomy of the gland.[1] In the fœtal pig it is comparatively very long, extending usually from a point over the upper half or third of the heart, underneath the sternum (as viewed from the ventral side), and up to the base of the mandible. The portion covering the heart is strongly attached to the pericardium; it is roughly triangular in shape, with the apex pointing posteriorly, and lies mainly to the left of the median line. The anterior end of this, the thoracic

1. In a further paper (7) Badertscher discusses the development of the thymus in the pig from the standpoint of histogenesis.

portion of the gland, narrows down, and the thymus appears beneath the sternum as two slender, parallel ribbons of glandular tissue. Once into the neck region, however, these two ribbons become very much larger and diverge, passing anteriorly to the base of the mandible, one on each side. In the thyroid region they parallel each other closely, lying on opposite sides of the thyroid, and thus fairly close to the median line. Then each passes from here into deeper tissue and obliquely away from the median line, ending behind the mandible. The thymus seems to be made up of many small lobules, combined into larger lobes. The accompanying sketch will give, perhaps, a clearer idea of the form of the gland.



SKETCH of the THYMUS in SITU

TABLE NO. 1.

Table No. 1 shows the original data as taken in the laboratory concerning each pig, together with individual averages, sex averages, and litter averages. From the table all the derivations and calculations of the report will be taken. Its value lies largely in reference, and will not be used much to point out conclusions. However, it is well to note from it the number of pigs dissected, namely, 147 from 18 different litters.

RELATION OF SEX TO THYMUS.

An examination of the averages listed beneath each litter in table No. 1 will readily show, in regard to sex, that males and females have practically the same percentage of thymus in the same stage of development. Consider particularly the percentage thymus by weight as balanced against the length of the pig, and this statement becomes evident. It is true that in several of the litters the females have the greater percentage of gland, but this tendency is practically balanced by the fact that many of the litters show approximately equal averages for males and females, and others show the balance in favor of the males. If our results be taken to show any positive tendency at all, it is that the females have the larger thymi (proportionally), but the writers believe that this is due to the small number of pigs dissected, and that such a positive tendency is too weak to merit much consideration. As such, special curves and tables have not been made for this part of the report. Notwithstanding, Hatai (4) in relevant material states that "so far as our present data are concerned, the thymus gland of the female of the albino rat appears to be slightly heavier than that of the male; nevertheless, the difference found is too slight to justify treating the sexes separately."

TABLE No. 1.

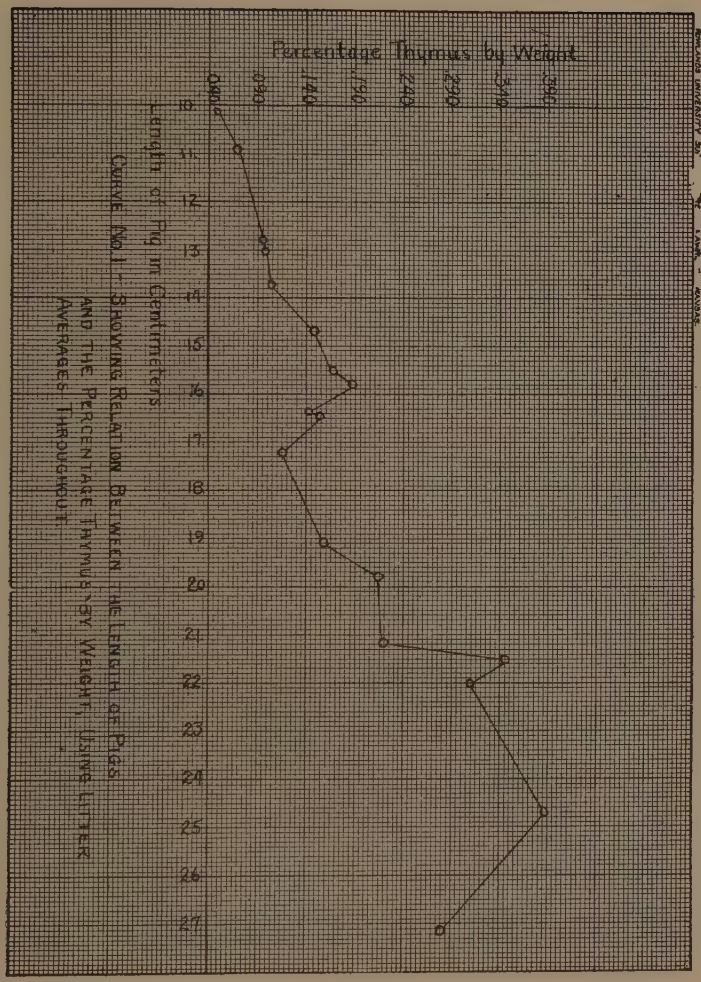
Pig.	Sex.	Pig length in cms.	Thymus length in cms.	Per cent by length.	Pig weight in grams.	Thymus weight in grams.	Per cent by weight.
1 A1	Male	15.5	4.0	25.8	235	.310	.132
2 A2	Male	15.0	3.75	25.0	192	.454	.236
3 A3	Male	15.5	3.8	24.5	233	.255	.109
4 A4	Male	15.5	3.8	24.5	202	.260	.129
5 A5	Male	16.0	4.0	25.0	212	.295	.134
6 A6	Female	17.5	4.5	25.7	265	.503	.189
7 A7	Female	16.0	3.5	21.9	237	.636	.268
8 A8	Male	16.0	3.7	23.1	228	.325	.143
9 A9	Male	16.5	3.7	22.4	243	.402	.165
10 A10	Male	15.5	3.8	24.5	228	.295	.129
11 A11	Male	14.0	3.5	25.0	174	.205	.118
12 A12	Male	16.0	3.8	23.8	234	.350	.150
13 A13	Male	11.5	2.3	20.0	102	.140	.137
14 A14	Male	17.0	4.5	26.5	265	.661	.287
Averages....	Male, 86 per cent.	15.3	3.72	24.2	212	.329	.156
	Female, 14 per cent.	16.8	4.0	23.8	251	.569	.229
	Litter	15.5	3.8	24.1	218	.364	.166
15 B1	Male	11.0	2.5	22.7	100	.070	.070
16 B2	Female	11.0	2.75	25.0	102	.095	.093
17 B3	Female	10.0	2.5	25.0	76	.031	.041
18 B4	Male	10.5	.....	.....	89	.....	.....
19 B5	Female	11.0	2.75	25.0	90	.070	.078
Averages....	Male, 40 per cent.	11.0	2.5	22.7	100	.070	.070
	Female, 60 per cent.	10.7	2.7	25.0	89	.065	.071
	Litter	10.9	2.6	24.4	92	.067	.071
20 C1	Female	11.5	2.5	21.7	107	.120	.112
21 C2	Male	13.0	2.5	19.2	145	.121	.083
22 C3	Female	13.5	2.7	20.0	136	.130	.096
23 C4	Female	13.0	2.5	19.2	123	.150	.122
24 C5	Male	13.0	2.5	19.2	122	.130	.107
25 C6	Male	14.0	3.5	25.0	164	.150	.091
26 C7	Female	14.0	4.0	28.6	143	.134	.094
27 C8	Male	11.5	2.5	21.7	102	.110	.108
28 C9	Male	13.5	3.25	24.1	164	.158	.096
Averages....	Male, 56 per cent.	13.0	2.85	21.8	139	.134	.097
	Female, 44 per cent.	13.0	2.9	22.3	127	.134	.106
	Litter	13.0	2.9	22.1	134	.134	.101
29 D1	Male	25.0	6.5	26.0	752	2.986	.397
30 D2	Male	25.0	7.0	28.0	771	2.580	.334
31 D3	Male	25.0	7.5	30.0	815	2.860	.351
32 D4	Female	25.0	7.0	28.0	843	3.550	.421
33 D5	Male	23.5	7.0	29.8	669	2.788	.417
Averages....	Male, 80 per cent.	24.6	7.0	28.5	752	2.804	.375
	Female, 20 per cent.	25.0	7.0	28.0	843	3.550	.421
	Litter	24.7	7.0	28.4	770	2.953	.384
34 E1	Female	14.5	3.4	23.5	184	.276	.150
35 E2	Female	15.0	3.5	23.3	196	.268	.137
36 E3	Male	15.0	3.5	23.3	211	.238	.113
37 E4	Male	15.0	3.5	23.3	208	.410	.197
38 E5	Male	16.0	3.5	21.9	195	.250	.128
39 E6	Male	12.5	3.0	24.0	126	.180	.143
Averages....	Male, 67 per cent.	14.6	3.4	23.1	185	.269	.145
	Female, 33 per cent.	14.8	3.4	23.4	190	.272	.144
	Litter	14.7	3.4	23.2	187	.270	.145
40 F1	Female	13.5	3.0	22.2	122	.125	.102
41 F2	Female	13.5	3.0	22.2	130	.214	.165
42 F3	Male	13.0	3.0	23.1	115	.184	.160
43 F4	Male	13.0	3.2	24.6	115	.085	.074
44 F5	Female	13.0	3.2	24.6	120	.115	.096
45 F6	Male	13.0	2.5	19.2	102	.080	.078
46 F7	Male	12.0	2.75	22.9	95	.068	.072
47 F8	.....	13.5	.....	.....	.....	.....	.....
48 F9	Male	13.5	3.0	22.2	140	.082	.059
49 F10	Female	12.5	3.2	25.6	120	.108	.090
50 F11	Female	11.0	2.5	22.7	83	.072	.087
51 F12	Male	13.0	3.3	25.4	126	.117	.093
52 F13	Female	12.0	2.6	21.7	96	.085	.089
Averages....	Male, 50 per cent.	12.9	2.96	22.9	116	.103	.089
	Females, 50 per cent.	12.6	2.9	23.2	112	.120	.105
	Litter	12.8	3.0	23.0	114	.111	.097

TABLE No. 1—CONTINUED.

Pig.	Sex.	Pig length in cms.	Thymus length in cms.	Per cent by length.	Pig weight in grams.	Thymus weight in grams.	Per cent by weight.
53 G1		22.0	6.0	27.3	635	3.241	.510
54 G2		22.0	5.5	25.0	549	1.280	.233
55 G3		22.0	6.2	28.2	665	1.900	.286
56 G4	Males, 5	22.0	6.0	27.3	658	2.914	.443
57 G5	Females, 3	21.5	5.8	27.0	640	1.999	.312
58 G6		21.5	5.5	25.6	581	2.379	.409
59 G7		22.0	6.0	27.3	635	2.205	.347
60 G8		19.0	5.2	27.4	346	.755	.218
Averages	Male, 63 per cent. / Female, 37 per cent.	21.5	5.8	26.9	589	2.084	.345
61 H1	Male	17.0	4.5	26.5	251	.305	.122
62 H2	Male	16.0	4.3	26.9	257	.420	.163
63 H3	Female	16.5	4.0	24.2	271	.751	.277
64 H4	Male	12.5	3.3	26.4	118	.133	.112
65 H5	Male	13.5	4.0	29.6	154	.323	.209
66 H6	Female	16.0	4.0	25.0	235	.519	.221
67 H7	Male	17.5	4.5	25.7	318	.705	.222
68 H8	Male	14.0	3.2	22.9	159	.205	.129
69 H9	Male	18.0	4.5	25.0	316	.847	.268
70 H10	Male	16.5	3.8	23.0	245	.410	.168
Averages	Male, 80 per cent. / Female, 20 per cent. / Litter	15.6 / 16.25 / 15.8	4.0 / 4.0 / 4.0	25.8 / 24.6 / 25.5	227 / 253 / 232	.419 / .635 / .462	.174 / .249 / .189
71 I1	Male	14.0	3.7	26.4	137	.137	.100
72 I2	Female	13.5	2.9	21.5	135	.170	.126
73 I3	Female	14.0	3.5	25.0	125	.114	.091
74 I4	Male	14.0	3.5	25.0	150	.160	.107
75 I5	Male	13.5	3.2	23.7	145	.120	.083
76 I6	Female	13.5	3.1	23.0	137	.155	.113
77 I7	Female	13.5	3.2	23.7	145	.160	.110
78 I8	Male	13.5	3.3	24.4	143	.142	.099
Averages	Male, 50 per cent. / Female, 50 per cent. / Litter	13.8 / 13.6 / 13.7	3.4 / 3.2 / 3.3	24.9 / 23.3 / 24.1	144 / 136 / 140	.140 / .150 / .145	.097 / .110 / .104
79 J1	Male	17.0	4.3	25.3	267	.332	.124
80 J2	Male	18.5	4.3	23.2	295	.385	.131
81 J3	Male	17.0	4.5	26.5	285	.320	.112
82 J4	Male	17.5	4.0	22.9	255	.340	.113
83 J5	Female	17.5	4.0	22.9	245	.228	.094
84 J6	Female	17.0	4.0	23.5	250	.232	.093
85 J7	Male	17.0	4.0	23.5	228	.260	.114
86 J8	Male	16.0	4.0	25.0	205	.280	.137
Averages	Male, 75 per cent. / Female, 25 per cent. / Litter	17.17 / 17.25 / 17.2	4.2 / 4.0 / 4.1	24.4 / 23.2 / 24.1	256 / 248 / 254	.319 / .230 / .297	.122 / .093 / .115
87 K1	Male	19.5	5.5	28.2	440	.750	.170
88 K2	Male	20.0	4.5	22.5	460	.813	.177
89 K3	Female	20.0	5.0	25.0	430	1.055	.245
90 K4	Female	20.0	4.5	22.5	420	.820	.195
91 K5	Male	19.5	4.3	22.5	405	1.115	.275
Averages	Male, 60 per cent. / Female, 40 per cent. / Litter	19.7 / 20.0 / 19.8	4.7 / 4.8 / 4.76	24.4 / 23.8 / 24.1	435 / 425 / 431	.893 / .938 / .911	.207 / .220 / .212
92 L1	Male	16.5	4.4	26.7	270	.432	.160
93 L2	Male	16.5	4.4	26.7	245	.392	.160
94 L3	Female	17.0	4.2	24.7	270	.335	.124
95 L4	Male	16.5	3.5	21.2	250	.407	.163
96 L5	Male	16.5	4.3	26.0	250	.370	.148
97 L6	Female	16.5	4.2	25.5	240	.365	.152
98 L7	Male	16.5	4.5	27.3	250	.365	.146
99 L8	Male	15.5	3.6	23.2	125	.200	.160
Averages	Male, 75 per cent. / Female, 25 per cent. / Litter	16.3 / 16.8 / 16.4	4.1 / 4.2 / 4.1	25.2 / 25.1 / 25.1	232 / 255 / 238	.361 / .350 / .358	.156 / .138 / .152
100 M1	Male	21.5	6.0	27.9	515	1.220	.237
101 M2	Female	21.0	5.3	25.2	515	.920	.179
102 M3	Female	20.5	5.4	26.3	445	1.032	.232
103 M4	Female	21.0	5.3	25.2	475	1,183	.250
104 M5	Male	21.0	5.5	26.2	445	.887	.200
105 M6	Male	19.0	5.3	27.9	342	.685	.200
106 M7	Male	22.5	5.5	24.9	550	1.315	.239
107 M8	Male	22.0	5.5	25.0	500	1.255	.251
108 M9	Male	22.0	5.5	25.0	420	.772	.184
Averages	Male, 67 per cent. / Female, 33 per cent. / Litter	21.3 / 20.8 / 21.2	5.55 / 5.3 / 5.48	26.2 / 25.6 / 26.0	462 / 478 / 467	1.014 / 1.045 / 1.030	.218 / .220 / .219

TABLE No. 1—Concluded.

Pig.	Sex.	Pig length in cms.	Thymus length in cms.	Per cent by length.	Pig weight in grams.	Thymus weight in grams.	Per cent By weight.
109 N1	Female	19.0	4.5	23.7	400	.710	.178
110 N2	Male	19.5	4.6	23.6	360	.517	.144
111 N3	Male	19.0	4.8	25.3	420	.580	.138
112 N4	Male	19.5	5.0	25.6	430	.550	.128
113 N5	Male	18.5	4.5	24.3	360	.466	.130
114 N6	Male	18.5	4.5	24.3	380	.635	.167
115 N7	Female	19.0	4.3	22.6	395	.805	.204
116 N8	Male	19.5	5.0	25.6	407	.672	.165
Averages	Male, 75 per cent	19.1	4.7	24.8	393	.570	.145
	Female, 25 per cent	19.0	4.4	23.1	398	.757	.172
	Litter	19.1	4.65	24.4	394	.617	.157
117 O1	Male	14.0	3.5	25.0	170	.180	.106
118 O2	Female	17.0	4.7	27.6	275	.602	.219
119 O3	Female	16.5	4.2	25.5	280	.405	.145
120 O4	Male	16.0	4.6	28.7	230	.255	.111
121 O5	Female	16.0	4.2	26.3	263	.426	.162
122 O6	Female	17.0	4.1	24.1	262	.425	.162
123 O7	Male	18.0	4.5	25.0	313	.370	.118
124 O8	Female	16.5	4.1	24.8	290	.351	.121
Averages	Male, 38 per cent	16.0	4.2	26.2	238	.268	.112
	Female, 62 per cent	16.6	4.3	25.7	274	.442	.162
	Litter	16.4	4.2	25.9	260	.377	.143
125 P1	Male	24.5	6.4	26.1	735	2.285	.311
126 P2	Female	24.0	6.0	25.0	700	2.135	.305
127 P3	Female	23.5	6.0	25.5	590	1.610	.273
128 P4	Female	23.5	6.0	25.5	665	1.940	.292
129 P5	Female	24.5	6.0	24.5	675	1.975	.293
130 P6	Female	21.5	5.0	23.3	495	1.540	.311
131 P7	Female	20.5	5.5	26.8	435	1.375	.316
132 P8	Female	23.5	6.3	26.8	740	2.002	.271
133 P9	Male	22.0	6.1	27.7	620	1.930	.311
Averages	Male, 22 per cent	23.3	6.3	26.9	678	2.108	.311
	Female, 78 per cent	23.0	5.8	25.3	614	1.797	.294
	Litter	23.1	5.9	25.7	628	1.866	.298
134 Q1	Male	9.5	2.3	24.2	55	.019	.035
135 Q2	Male	10.5	2.5	23.8	68	.040	.059
136 Q3	Male	10.0	2.3	23.0	66	.032	.048
137 Q4	Female	10.0	2.2	22.0	63	.029	.046
138 Q5	Female	10.5	2.3	21.9	63	.022	.035
139 Q6	Male	10.0	2.4	24.0	63	.025	.040
140 Q7	Female	10.0	2.5	25.0	61	.035	.057
141 Q8	Female	10.5	2.5	23.8	61	.032	.052
Averages	Male, 50 per cent	10.0	2.4	23.8	63	.029	.046
	Female, 50 per cent	10.3	2.4	23.2	62	.030	.048
	Litter	10.1	2.4	23.5	63	.029	.047
142 R1	Male	27.0	9.0	33.3	1,098	2.480	.226
143 R2	Male	25.5	7.0	27.5	693	1.549	.224
144 R3	Male	27.5	8.0	29.1	932	3.365	.361
145 R4	Male	27.5	7.5	27.3	999	3.010	.301
146 R5	Female	26.5	8.6	32.5	925	2.500	.270
147 R6	Male	28.5	9.0	31.6	1,035	2,972	.287
Averages	Male, 83 per cent	27.2	8.1	29.8	951	2,675	.280
	Female, 17 per cent	26.5	8.6	32.5	925	2.500	.270
	Litter	27.1	8.2	30.2	947	2.646	.278

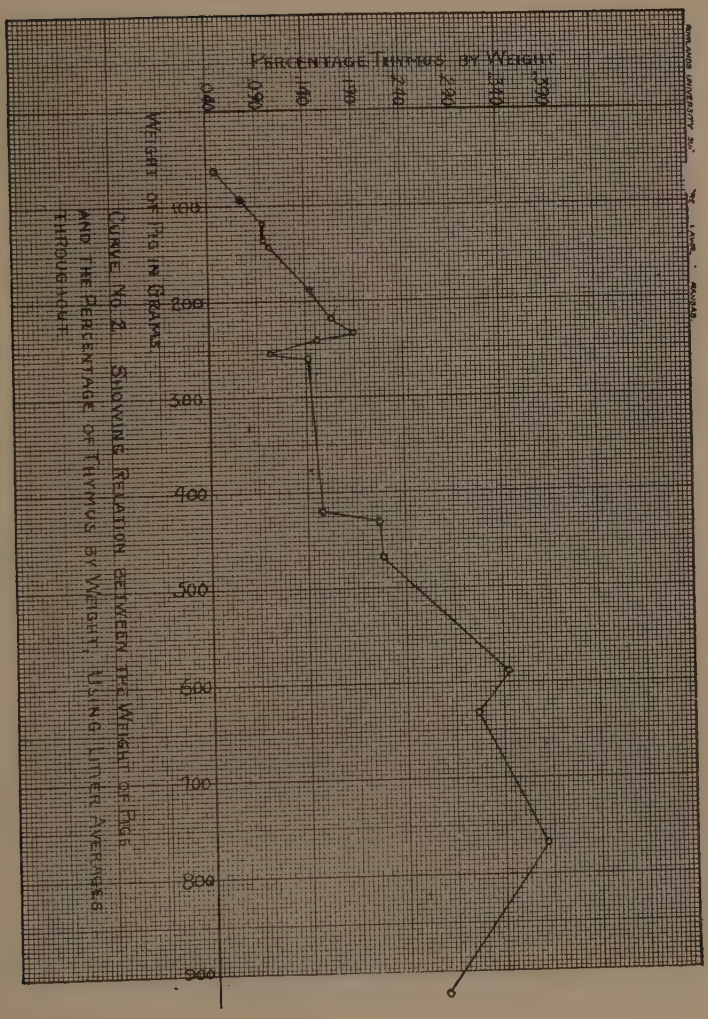

Percentage Thymus by Weight
0.00
0.50
1.00
1.50
2.00
2.50
3.00
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
Length of Pig in Centimeters
CURVE (Vol. I) SHOWING RELATION BETWEEN THE LENGTH OF PIGS
AND THE PERCENTAGE THYMUS BY WEIGHT, USING LITTER
AVERAGES THROUGHOUT.

Relation Between the Length of Pigs and the Percentage Thymus by Weight, Using Litter Averages Throughout.

Table No. 2 and curve No. 1 are to be considered in this connection. Curve No. 1 shows that as litters made up of larger and larger fœti, as regards length, are examined, the percentage thymus by weight increases steadily. There is a marked drop near the center of the curve which cannot be explained, but it does not obscure the general tendency of an increase in percentage thymus by weight. It will be noted that the value for the litter of pigs of average length, 27.1 centimeters, has dropped quite appreciably. Whether or not this means that at 24 cm. or 25 cm. the gland reaches its greatest stage of development we do not know; not enough pigs longer than 25 cm. were examined. It would be an interesting problem to work out to see at just what stage the thymus development ceases, and when it commences to atrophy.

TABLE No. 2.

Litter.	Pig length in cms.	Thymus length in cms.	Per cent by length.	Pig weight in gms.	Thymus weight in gms.	Per cent by weight.
Q	10.1	2.4	23.5	63	.029	.047
B	10.9	2.6	24.4	92	.067	.071
F	12.8	3.0	23.0	114	.111	.097
C	13.0	2.9	22.1	134	.134	.101
I	13.7	3.3	24.1	140	.145	.104
E	14.7	3.4	23.2	187	.270	.145
A	15.5	3.8	24.1	218	.364	.166
H	15.8	4.0	25.5	232	.462	.189
L	16.4	4.1	25.1	238	.358	.152
O	16.4	4.2	25.9	260	.377	.143
J	17.2	4.1	24.1	254	.297	.115
N	19.1	4.7	24.4	419	.617	.157
K	19.8	4.8	24.1	431	.911	.212
M	21.2	5.5	26.0	467	1.030	.219
G	21.5	5.8	26.9	589	2.084	.345
P	22.0	6.1	27.7	628	1.930	.311
D	24.7	7.0	28.4	770	2.953	.384
R	27.1	8.2	30.2	947	2.646	.278


Percentage Thymus by Weight
.050
.100
.150
.200
.250
.300
.350
100
200
300
400
500
600
700
800
900
Weight of Pig in Grams
Curve No. 2. Showing Relation between the Weight of Pig and the Percentage of Thymus by Weight, Using Litter Averages Throughout

RELATION BETWEEN THE WEIGHT OF PIGS AND THE PERCENTAGE THYMUS BY WEIGHT, USING LITTER AVERAGES THROUGHOUT.

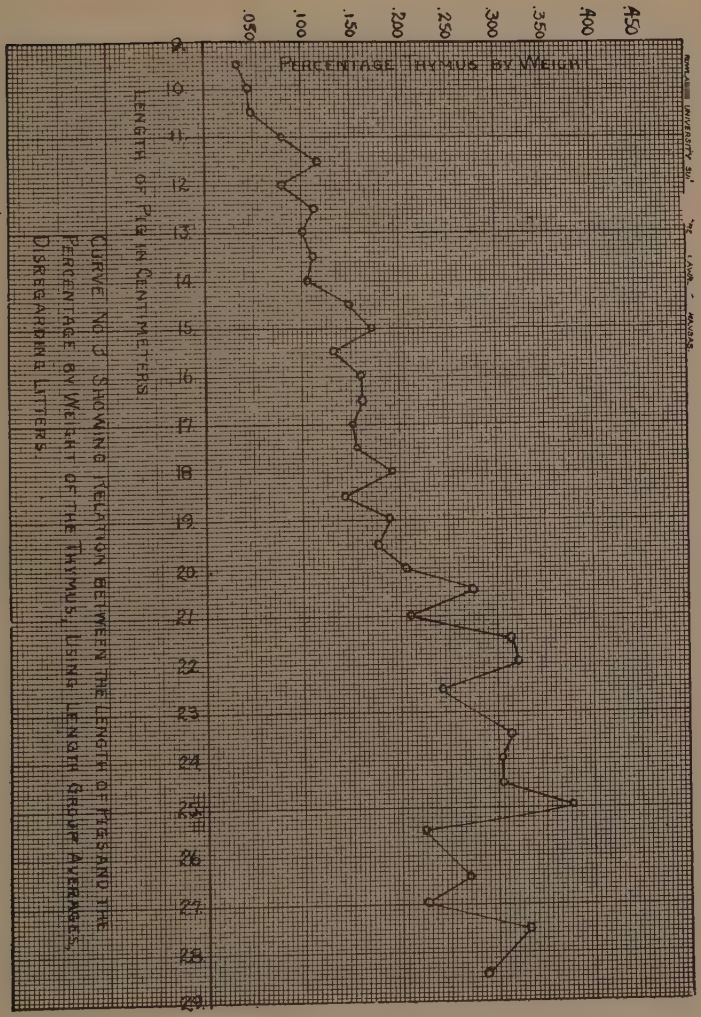
Table No. 3 and curve No. 2 show practically the same tendency as to table No. 2 and curve No. 1, *i. e.*, as heavier and heavier pigs are examined, the percentage of thymus by weight increases steadily. There is practically the same inexplicable deviation or drop near the center of the curve, and the possible maximum point centering about pigs of a weight of 770 grams.

TABLE No. 3.

LITTER.	Pig weight in gms.	Thymus weight in gms.	Per cent by weight.	Pig length in cms.	Thymus length. in cms.	Per cent by length.
Q	63	.029	.047	10.1	2.4	23.5
B	92	.067	.071	10.9	2.6	24.4
F	114	.111	.097	12.8	3.0	23.0
C	134	.134	.101	13.0	2.9	22.1
I	140	.145	.104	13.7	3.3	24.1
E	187	.270	.145	14.7	3.4	23.2
A	218	.364	.166	15.5	3.8	24.1
H	232	.462	.189	15.8	4.0	25.5
L	238	.358	.152	16.4	4.1	25.1
J	254	.297	.115	17.2	4.1	24.1
O	260	.377	.143	16.4	4.2	25.9
N	419	.617	.157	19.1	4.7	24.4
K	431	.911	.212	19.8	4.8	24.1
M	467	1.030	.219	21.2	5.5	26.0
G	589	2.084	.345	21.5	5.8	26.9
P	628	1.930	.311	22.0	6.1	27.7
D	770	2.953	.384	24.7	7.0	28.4
R	947	2.646	.278	27.1	8.2	30.2

RELATION BETWEEN THE LENGTH OF PIGS AND THE PERCENTAGE BY WEIGHT OF THE THYMUS, USING LENGTH GROUP AVERAGES THROUGHOUT, DISREGARDING LITTERS.

Table No. 4 and curve No. 3 show that as larger and larger fœti (as regards length) are examined and classified regardless of litter, there is a steady increase in the percentage thymus by weight. The increase is not as uniform, however, as when the pigs are classified according to litter, as will be shown by a comparison of curve No. 1 with curve No. 3. The former is the smoother. Hence from these calculations on lengths, we may conclude that pigs tend to have the same size thymus, relatively, as that of other pigs of the same litter, regardless of individual pig lengths.


PERCENTAGE THYMUS BY WEIGHT
.050
.100
.150
.200
.250
.300
.350
.400
.450
LENGTH OF PIG IN CENTIMETERS
9
10
11
12
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28
29
CURVE NO. 3 SHOWING RELATION BETWEEN THE LENGTH OF PIGS AND THE PERCENTAGE BY WEIGHT OF THE THYMUS, USING LENGTH GROUP AVERAGES. DISREGARDING LITTERS.

TABLE No. 4.

Class.	Pig.	Per cent thymus by weight.	Pig weight in gms.	Per cent thymus by length.	Class.	Pig.	Per cent thymus by weight.	Pig weight in gms.	Per cent thymus by length.
9.5 cm....	Q1	.035	55	24.2	15.0 cm....	A2	.236	192	25.0
	Avg.	.035	55	24.2		E1	.137	196	23.3
						E4	.197	208	23.3
10.0 cm....	Q7	.057	61	25.0		E3	.113	211	23.3
	Q6	.040	63	24.0		Avg.	.171	202	23.7
	Q4	.046	63	22.0					
	Q3	.048	66	23.0	15.5 cm....	L8	.160	175	23.2
	B3	.041	76	25.0		A4	.129	202	24.5
	Avg.	.046	66	24.0		A10	.129	228	24.5
						A3	.109	233	24.5
10.5 cm....	Q8	.052	61	33.8		A1	.132	235	25.8
	Q5	.035	63	21.9		Avg.	.132	215	24.5
	Q2	.059	68	23.8					
	Avg.	.049	64	26.5	16.0 cm....	E5	.128	195	21.9
						J8	.137	205	25.0
11.0 cm....	F11	.087	83	22.7		A5	.134	212	25.0
	B5	.078	90	25.0		A8	.143	228	23.1
	B1	.070	100	22.7		O4	.111	230	28.7
	B2	.093	102	25.0		A12	.150	234	23.8
	Avg.	.082	94	23.9		H6	.221	235	25.4
						A7	.268	237	21.9
11.5 cm....	C8	.108	102	21.7		H2	.163	257	26.9
	A13	.137	102	20.0		O5	.162	263	26.3
	C1	.112	107	21.7		Avg.	.162	230	24.8
	Avg.	.119	104	21.1					
					16.5 cm....	L6	.152	240	25.5
12.0 cm....	F7	.072	95	22.9		A9	.165	243	22.4
	F13	.089	96	21.7		L2	.160	245	26.7
	Avg.	.081	95.5	22.3		H10	.168	245	23.0
						L7	.146	250	27.3
12.5 cm....	H4	.112	118	26.4		L5	.148	250	26.0
	F10	.090	120	25.6		L4	.163	250	21.2
	E6	.143	126	24.0		L1	.160	270	26.7
	Avg.	.115	121	25.3		H3	.277	271	24.2
						O3	.145	280	25.5
13.0 cm....	F6	.078	102	19.2		O8	.121	290	24.8
	F4	.074	115	24.6		Avg.	.164	258	24.8
	F3	.160	115	23.1					
	F5	.096	120	24.6	17.0 cm....	J7	.114	228	23.5
	C5	.107	122	19.2		J6	.093	250	23.5
	C4	.122	123	19.2		H1	.123	251	26.5
	F12	.093	126	25.4		O6	.162	262	24.1
	C2	.083	145	19.2		A14	.287	265	26.5
	Avg.	.102	121	21.8		J1	.124	267	25.3
						L3	.124	270	24.7
13.5 cm....	F1	.102	122	22.2		O2	.219	275	27.6
	F2	.165	130	22.2		J3	.112	285	26.5
	I2	.126	135	21.5		Avg.	.151	261	25.4
	C3	.096	136	20.0					
	I6	.113	137	23.0	17.5 cm....	J5	.094	245	22.9
	E9	.059	140	22.2		J4	.113	255	22.9
	I8	.099	143	24.4		A6	.189	265	25.7
	I5	.083	145	23.7		H7	.222	318	25.0
	I7	.110	145	23.7		Avg.	.155	271	24.1
	H5	.209	159	29.6					
	C9	.096	164	24.1	18.0 cm....	O7	.118	313	25.0
	Avg.	.114	141	23.3		H9	.269	316	25.0
						Avg.	.194	314.5	25.0
14.0 cm....	I3	.091	125	25.0					
	I1	.100	137	26.4	18.5 cm....	J2	.131	295	23.2
	C7	.094	143	28.6		N5	.130	360	24.3
	J4	.107	150	25.0		N6	.167	380	25.4
	H8	.129	159	22.9		Avg.	.143	345	24.3
	C6	.091	164	25.0					
	O1	.106	170	25.0	19.0 cm....	M6	.200	342	27.9
	A11	.118	174	25.0		G8	.218	346	27.4
	Avg.	.105	153	25.4		N7	.204	395	22.6
						N1	.178	400	23.7
14.5 cm....	E1	.150	184	23.5		N3	.138	420	25.3
	Avg.	.150	184	23.5		Avg.	.188	381	25.4

TABLE No. 4—Concluded.

Class.	Pig.	Per cent thymus by weight.	Pig weight in gms.	Per cent thymus by length.	Class.	Pig.	Per cent thymus by weight.	Pig weight in gms.	Per cent thymus by length.
19.5 cm....	N2	.144	360	23.6	22.5 cm....	M7	.239	550	24.9
	K5	.275	405	22.5		Avg.	.239	550	24.9
	N8	.165	407	25.6					
	N4	.128	430	25.6	23.5 cm....	P3	.273	590	25.5
	K1	.170	440	28.2		P4	.292	665	25.5
	Avg.	.176	408	25.1		D5	.417	669	29.8
						P8	.271	740	26.8
20.0 cm....	K4	.195	420	22.5		Avg.	.313	666	26.9
	K3	.245	430	25.0					
	K2	.177	460	22.5	24.0 cm....	P2	.305	700	25.0
	Avg.	.206	437	23.3		Avg.	.305	700	25.0
20.5 cm....	P7	.316	435	26.8	24.5 cm....	P1	.311	735	26.1
	M3	.232	445	26.3		P5	.293	675	24.5
	Avg.	.274	440	26.6		Avg.	.302	705	25.8
21.0 cm....	M5	.200	445	26.2	25.0 cm....	D1	.397	752	26.0
	M4	.250	475	25.2		D2	.334	771	28.0
	M2	.179	515	25.2		D3	.351	815	30.0
	Avg.	.210	478	25.5		D4	.421	843	28.0
						Avg.	.376	795	28.0
21.5 cm....	P6	.311	495	23.3					
	M1	.237	515	27.9	25.5 cm....	P2	.224	693	27.5
	G6	.409	581	25.6		Avg.	.224	693	27.5
	G5	.312	640	27.0					
	Avg.	.317	558	26.0	26.5 cm....	R5	.270	925	32.5
						Avg.	.270	925	32.5
22.0 cm....	M9	.184	420	25.0					
	M8	.251	500	25.0	27.0 cm....	R1	.226	1,098	33.3
	G2	.233	549	25.0		Avg.	.226	1,098	33.3
	P9	.311	620	27.7					
	G7	.347	635	27.3	27.5 cm....	R3	.361	932	29.1
	G1	.510	635	27.3		R4	.301	999	27.3
	G4	.443	658	27.3		Avg.	.331	965.5	28.7
	G3	.286	665	28.2					
	Avg.	.321	585	26.6	28.5 cm....	R6	.287	1,035	31.6
						Avg.	.287	1,035	31.6

Relation Between the Weight of Pigs and the Percentage by Weight of the Thymus, Using Weight Group Averages Throughout, Disregarding Litters.

Table No. 5 and curve No. 4 show that as larger and larger fœti (as regards weight) are examined and classified regardless of litter, there is a steady increase in the percentage of thymus by weight. As has already been noted in curve No. 3, the increase is not uniform. When we compare this curve No. 4 with curve No. 2 (where the pigs are classified according to litters), it is evident that the latter is smoother by far. Hence from these calculations on weights in addition to the calculations already noted on lengths, we may conclude that pigs tend to have the same size thymus as that of other pigs in the same litter, regardless of individual sizes.

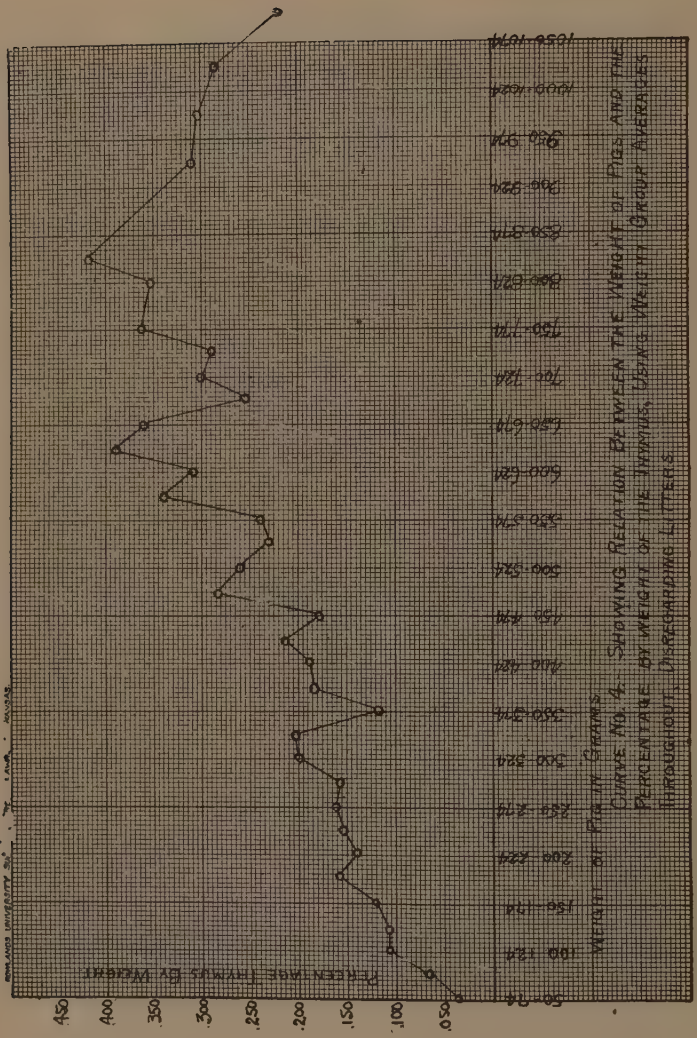
Curve No. 4. Showing Relation between the Weight of Pigs and the Percentage by Weight of the Thymus, using Weight Group Averages throughout. Regarding Litters.
Weight of Pig in Grams
Percentage Thymus by Weight
50-99 99
100-149 124
150-199 174
200-249 224
250-299 274
300-349 324
350-399 374
400-449 424
450-499 474
500-549 524
550-599 574
600-649 624
650-699 674
700-749 724
750-799 774
800-849 824
850-899 874
900-949 924
950-999 974
1000-1049 1024
1050-1099 1074
.050
.100
.150
.200
.250
.300
.350
.400
.450

TABLE No. 5.

Class.	Pig.	Pig weight in gms.	Per cent weight.	Pig length in cms.	Per cent length.
50–74	Q1	55	.035	9.5	24.2
	Q8	61	.052	10.5	23.8
	Q7	61	.057	10.0	25.0
	Q5	63	.035	10.5	21.9
	Q6	63	.040	10.0	24.0
	Q4	63	.046	10.0	22.0
	Q3	66	.048	10.0	23.0
	Q2	68	.059	10.5	23.8
	Avg.	.....	.0465	.....	23.47
75–99	B3	76	.041	10.0	25.0
	F11	83	.087	11.0	22.7
	B5	90	.078	11.0	25.0
	F7	95	.072	12.0	23.9
	F13	96	.089	12.0	21.7
	Avg.	.....	.0734	.....	23.66
100–124	B1	100	.070	11.0	22.7
	F6	102	.078	13.0	19.2
	B2	102	.093	11.0	25.0
	C8	102	.108	11.5	21.7
	A13	102	.137	11.5	20.0
	C1	107	.112	11.5	21.7
	F4	115	.074	13.0	24.6
	F3	115	.160	13.0	23.1
	H4	118	.112	12.5	26.4
	F10	120	.090	12.5	25.6
	F5	120	.096	13.0	24.6
	F1	122	.102	13.0	22.2
	C5	122	.107	13.0	19.2
	C4	123	.122	13.0	19.2
	Avg.	.....	.1115	.....	22.51
125–149	I3	125	.091	14.0	25.0
	L8	125	.160	15.5	23.2
	F12	126	.093	13.0	25.4
	E6	126	.143	12.5	24.0
	F2	130	.165	13.0	22.2
	I2	135	.126	13.5	21.5
	C3	136	.096	13.0	20.0
	I1	137	.100	14.0	26.4
	I6	137	.113	13.5	23.0
	F9	140	.059	13.5	22.2
	C7	143	.094	14.0	28.6
	I8	143	.099	13.5	24.4
	C2	145	.085	13.0	19.0
	I5	145	.083	13.5	23.7
	I7	145	.110	13.5	23.7
	Avg.	.....	.1078	.....	23.49
150–174	I4	150	.107	14.0	25.0
	H5	154	.209	13.5	29.6
	H8	159	.129	14.0	22.9
	C6	164	.091	14.0	25.0
	C9	164	.096	13.5	24.1
	O1	170	.106	14.0	25.0
	A11	174	.118	14.0	25.0
	Avg.	.....	.1223	.....	25.23
175–199	E1	184	.150	14.5	23.5
	A2	192	.236	15.0	25.0
	E5	195	.128	16.0	21.9
	E2	196	.137	15.7	23.3
	Avg.	.....	.1628	.....	23.43
200–224	A4	202	.129	15.5	24.5
	J8	205	.137	16.0	25.0
	E4	208	.197	15.0	23.5
	E3	211	.113	15.0	23.3
	A5	212	.134	16.0	25.0
	Avg.	.....	.1420	.....	24.26
225–249	J7	228	.114	17.0	23.5
	A10	228	.129	15.5	24.5
	A8	228	.143	16.0	23.1
	O4	230	.111	16.0	28.7
	A3	233	.109	15.5	24.5
	A12	234	.150	16.0	23.8
	A1	235	.132	15.5	25.8
	H6	235	.221	16.0	25.4
	A7	237	.268	16.0	21.9
	L6	240	.152	16.5	25.5
	A9	243	.243	16.5	22.4
	J5	245	.094	17.5	22.9
	L2	245	.160	16.5	26.7
	H10	245	.168	16.5	23.0
	Avg.	.....	.1567	.....	24.41
250–274	J6	250	.093	17.0	23.5
	L7	250	.146	16.5	27.3
	L5	250	.148	16.5	26.0
	L4	250	.163	16.5	21.2
	H1	251	.122	17.0	26.5
	J4	255	.113	17.5	22.9
	H2	257	.163	16.0	26.9
	O6	262	.162	17.0	24.1
	O5	263	.162	16.0	26.3
	A6	265	.189	17.5	25.7
	A14	265	.287	17.0	26.5
	J1	267	.124	17.0	25.3
	L3	270	.124	17.0	24.7
	L1	270	.160	16.5	26.7
	H3	271	.277	16.5	24.2
	Avg.	.....	.162	.....	25.5
275–299	O2	275	.219	17.0	27.6
	O3	280	.145	16.5	25.5
	J3	285	.112	17.0	26.5
	O8	290	.121	16.5	24.8
	J2	295	.131	18.5	23.2
	Avg.	.....	.146	.....	25.5
300–324	O7	313	.118	18.0	25.0
	H9	316	.268	18.0	25.0
	H7	318	.222	17.5	25.0
	Avg.	.....	.203	.....	25.0
325–349	M6	342	.200	19.0	27.9
	G8	346	.218	19.0	27.4
	Avg.	.....	.209	.....	27.3
350–374	N5	360	.130	18.5	24.3
	N2	360	.144	19.5	23.6
	Avg.	.....	.137	.....	24.0
375–399	N6	380	.167	18.5	24.3
	N7	395	.204	19.0	22.6
	Avg.	.....	.186	.....	23.5
400–424	H1	400	.178	19.0	23.7
	K5	405	.275	19.5	22.5
	N8	407	.165	19.5	25.6
	N3	420	.138	19.0	25.3
	M9	420	.184	22.0	25.0
	K4	420	.195	20.0	22.5
	Avg.	.....	.189	.....	24.1
425–449	N4	430	.128	19.5	25.6
	K3	430	.245	20.0	25.0
	P7	435	.316	20.5	26.8
	K1	440	.170	19.5	28.2
	M5	445	.200	21.0	26.2
	M3	445	.232	20.5	26.3
	Avg.	.....	.215	.....	26.4

TABLE No. 5—Concluded.

Class.	Pig.	Pig weight in gms.	Per cent weight.	Pig length. in cms.	Per cent length.	Class.	Pig.	Pig weight in gms.	Per cent weight.	Pig length in cms.	Per cent length.
450–474	K2	460	.177	20.0	22.5	675–699	P5	675	.293	24.5	24.5
	Avg.	.....	.177	.....	22.5		R2	693	.224	25.5	27.5
							Avg.	.....	.259	.....	26.0
475–499	M4	475	.250	21.0	25.2						
	P6	495	.311	21.5	23.3	700–724	P2	700	.305	24.0	25.0
	Avg.	.....	.281	.....	24.3		Avg.	.....	.305	.....	25.0
500–524	M8	500	.251	22.0	25.0	725–749	P1	735	.311	24.5	26.1
	M2	515	.179	21.0	25.2		P8	740	.271	23.5	26.8
	M1	515	.237	21.5	27.9		Avg.	.....	.291	.....	26.5
	Avg.	.....	.222	.....	26.0						
						750–774	D1	752	.397	25.0	26.0
525–544	G2	549	.233	22.0	25.0		D2	771	.334	25.0	28 0
	Avg.	.....	.233	.....	25.0		Avg.	.....	.366	.....	27.0
550–574	M7	550	.239	22.5	24.9	800–824	D3	815	.351	25.0	30.0
	Avg.	.....	.239	.....	24.9		Avg.	.....	.351	.....	30.0
575–599	G6	581	.409	21.5	25.6	825–849	D4	843	.421	25.0	28.0
	P3	590	.273	23.5	25.5		Avg.	.....	.421	.....	28.0
	Avg.	.....	.341	.....	25.6						
						925–949	R5	925	.270	26.5	32.5
600–624	P9	620	.311	22.0	27.7		R3	932	.361	27.5	29.1
	Avg.	.....	.311	.....	27.7		Avg.	.....	.316	.....	31.3
625–649	G7	635	.347	22.0	27.3	974–999	R4	999	.301	27.5	27.3
	G1	635	.510	22.0	27.3		Avg.	.....	.301	.....	27.3
	G5	640	.312	21.5	27.0						
	Avg.	.....	.390	.....	27.3	1025–1049	R6	1,035	.287	28.5	31.6
							Avg.	.....	.287	.....	31.6
650–674	G4	658	.443	22.0	27.3						
	G3	665	.286	22.0	28.2	1075–1099	R1	1,098	.226	27.0	33.3
	P4	665	.292	23.5	25.5		Avg.	.....	.226	.....	33.3
	D5	669	.417	23.5	29.8						
	Avg.	.....	.360	.....	27.7						

Comparisons Made to Correlate the Size of Underdeveloped and Overdeveloped Pigs with the Size of the Thymus, Taking Percentage Thymus by Weight as a Standard, and Grading Pigs in the Litters by Length.

As the title above indicates, table No. 6 is the result of an attempt made to correlate the size of underdeveloped and overdeveloped pigs with the size of the thymus, taking percentage thymus by weight as a standard, and grading pigs in the litters by length. In each litter the two smallest fœti (by length) and the two largest were studied as to percentage thymus by weight as seen in column F in the table. The percentages of the two smallest and the two largest were individually averaged (column G), and the two averages compared; the correlation noted was recorded in column H. Positive or + correlation is taken to mean that the overdeveloped pigs in the litter had a greater percentage of thymus than the underdeveloped pigs. As seen from the table, there were nine positives and nine negatives, hence we must conclude, from the data at hand now, that no parallelism exists between the large and small size, respectively, of underdeveloped and overdeveloped fœti, and the percentage of thymus by weight.

TABLE No. 6.

Column A. Serial No.	Column B. Litter No.	Column C. Pig length in centimeters.	Column D. Per cent thymus by length.	Column E. Pig weight in grams.	Column F. Per cent thymus by weight.	Column G. Averages of column F.	Column H. Correlation.
13	A13	11.5	20.0	102	.137	.128	+
11	A11	14.0	25.0	174	.118		
6	A6	17.5	25.7	265	.189	.238	
14	A14	17.0	26.5	265	.287		
17	B3	10.0	25.0	76	.041	.065	+
19	B5	11.0	25.0	90	.078		
16	B2	11.0	25.0	102	.093	.082	
15	B1	11.0	22.7	100	.070		
27	C8	11.5	21.7	102	.108	.110	−
20	C1	11.5	21.7	107	.112		
26	C7	14.0	28.6	143	.094	.093	
25	C6	14.0	25.0	164	.091		
33	D5	23.5	29.8	669	.417	.407	−
29	D1	25.0	26.0	752	.397		
32	D4	25.0	28.0	843	.421	.386	
31	D3	25.0	30.0	815	.351		
39	E6	12.5	24.0	126	.143	.147	−
34	E1	14.5	23.5	184	.150		
38	E5	16.0	21.9	195	.128	.121	
36	E3	15.0	23.3	211	.113		
50	F11	11.0	22.7	83	.087	.079	+
46	F7	12.0	22.9	95	.072		
48	F9	13.5	22.2	140	.059	.112	
41	F2	13.5	22.2	130	.165		
60	G8	19.0	27.4	346	.218	.314	+
58	G6	21.5	25.6	581	.409		
53	G1	22.0	27.3	635	.510	.429	
59	G7	22.0	27.3	635	.347		
64	H4	12.5	26.4	118	.112	.162	+
65	H5	13.5	29.6	154	.209		
69	H9	18.0	25.0	316	.268	.245	
67	H7	17.5	25.7	318	.222		
72	I2	13.5	21.5	135	.126	.120	−
76	I6	13.5	23.0	137	.113		
74	I4	14.0	25.0	150	.107	.104	
71	I1	14.0	26.4	137	.100		
86	J8	16.0	25.0	205	.137	.126	−
85	J7	17.0	23.5	228	.114		
80	J2	18.5	23.2	295	.131	.122	
82	J4	17.5	22.9	255	.113		
91	K5	19.5	22.5	405	.275	.223	−
87	K1	19.5	28.2	440	.170		
88	K7	20.0	22.5	460	.177	.211	
89	K3	20.0	25.0	430	.245		
99	L8	15.5	23.2	125	.160	.156	−
97	L6	16.5	25.5	240	.152		
94	L3	17.0	24.7	270	.124	.142	
92	L1	16.5	26.7	270	.160		

TABLE No. 6—CONCLUDED.

Column A. Serial No.	Column B. Litter No.	Column C. Pig length in centimeters.	Column D. Per cent thymus by length.	Column E. Pig weight in grams.	Column F. Per cent thymus by weight.	Column G. Averages of column F.	Column H. Correlation.
105	M6.....	19.0	27.9	342	.200	.216	+
102	M3.....	20.5	26.3	445	.232		
106	M7.....	22.5	24.9	550	.239	.245	
107	M8.....	22.0	25.0	500	.251		
113	N5.....	18.5	24.3	360	.130	.149	—
114	N6.....	18.5	24.3	380	.167		
112	N4.....	19.5	25.6	430	.128	.147	
116	N8.....	19.5	25.6	407	.165		
117	O1.....	14.0	25.0	170	.106	.109	+
120	O4.....	16.0	28.7	230	.111		
123	O7.....	18.0	25.0	313	.118	.169	
118	O2.....	17.0	27.6	275	.219		
131	P7.....	20.5	26.8	435	.316	.314	—
130	P6.....	21.5	23.3	495	.311		
125	P1.....	24.5	26.1	735	.311	.302	
129	P5.....	24.5	24.5	675	.293		
134	Q1.....	9.5	24.2	55	.035	.046	+
140	Q7.....	10.0	25.0	61	.057		
135	Q2.....	10.5	23.8	68	.059	.047	
138	Q5.....	10.5	21.9	63	.035		
143	R2.....	25.5	27.5	693	.224	.247	+
146	R5.....	26.5	32.5	925	.270		
147	R6.....	28.5	31.6	1,035	.287	.294	
145	R4.....	27.5	27.3	999	.301		

Total result, 9+, 9 —.

COMPARISONS MADE TO CORRELATE THE SIZE OF UNDERDEVELOPED AND OVERDEVELOPED PIGS WITH THE SIZE OF THE THYMUS, TAKING PERCENTAGE OF THYMUS BY WEIGHT AS A STANDARD, AND GRADING PIGS IN THE LITTERS BY WEIGHT.

As the title above indicates, table No. 7 is the result of an attempt made to correlate the size of underdeveloped and overdeveloped fœti with the size of the thymus, taking percentage thymus by weight as a standard, and grading pigs in the litters by weight. In each litter the two smallest fœti (by weight) and the two largest were studied as to percentage thymus by weight as seen in column F in the table. The percentages of the two smallest and the two largest were individually averaged (column G), and the two averages compared; the correlation noted was recorded in column H. Positive or + correlation is taken to mean that the overdeveloped pigs in the litter had a greater percentage of thymus than the underdeveloped pigs. As seen from the table, there were ten positives and eight negatives. This is indeed a very weak positive correlation; so slight, in fact, that we feel that it must be disregarded until more positive data can be secured. Hence, once more we must decide, on the basis of the data at hand now, that no parallelism exists between the large and small size, respectively, of underdeveloped and overdeveloped fœti and the percentage of thymus by weight.

TABLE No. 7.

Column A. Serial No.	Column B. Litter No.	Column C. Pig weight in grams.	Column D. Pig length in centimeters.	Column E. Per cent thymus by length.	Column F. Per cent thymus by weight.	Column G. Averages of column F.	Column H. Correlation.
13	A13	102	11.5	20.0	.137	.128	+
11	A11	174	14.0	25.0	.118		
14	A14	265	17.0	26.5	.287	.238	
6	A6	265	17.5	25.7	.189		
17	B3	76	10.0	25.0	.041	.060	+
19	B5	90	11.0	25.0	.078		
15	B1	100	11.0	22.7	.070	.082	
16	B7	102	11.0	25.0	.073		
27	C8	102	11.5	21.7	.108	.108	−
24	C5	122	13.0	19.2	.107		
25	C6	164	14.0	25.0	.091	.094	
28	C9	164	13.5	24.1	.096		
33	D5	669	23.5	29.8	.417	.407	−
29	D1	752	25.0	26.0	.397		
32	D4	843	25.0	28.0	.421	.386	
31	D3	815	25.0	30.0	.351		
39	E6	126	12.5	24.0	.143	.147	+
34	E1	184	14.5	23.5	.150		
37	E4	208	15.0	23.3	.197	.155	
36	E3	211	15.0	23.3	.113		
50	F11	83	11.0	22.7	.087	.080	+
46	F7	95	12.0	22.9	.072		
41	F2	130	13.5	22.2	.165	.112	
48	F9	140	13.5	22.2	.059		
60	G8	346	19.0	27.4	.218	.226	+
54	G2	549	22.0	25.0	.233		
55	G3	665	22.0	28.2	.286	.365	
56	G4	658	22.0	27.3	.443		
64	H4	118	12.5	26.4	.112	.162	+
65	H5	154	13.5	29.6	.209		
67	H7	318	17.5	25.7	.222	.245	
69	H9	316	18.0	25.0	.268		
73	I3	125	14.0	25.0	.091	.109	−
72	I2	135	13.5	21.5	.126		
67	I4	150	14.0	25.0	.107	.095	
69	I5	145	13.5	23.7	.083		
86	J8	205	16.0	25.0	.137	.126	−
85	J7	228	17.0	23.5	.114		
80	J2	295	18.5	23.2	.131	.122	
81	J3	285	17.0	26.5	.112		
91	K5	405	19.5	22.5	.275	.235	−
90	K4	420	20.0	22.5	.195		
88	K2	460	20.0	22.5	.177	.174	
87	K1	440	19.5	28.2	.170		
99	L8	125	15.5	23.2	.160	.156	−
97	L6	240	16.5	25.5	.152		
94	L3	270	17.0	24.7	.124	.142	
92	L1	270	16.5	26.7	.160		

TABLE No. 7—Concluded.

Column A. Serial No.	Column B. Litter No.	Column C. Pig weight in grams.	Column D. Pig length in centimeters.	Column E. Per cent thymus by length.	Column F. Per cent thymus by weight.	Column G. Averages of column F.	Column H. Correlation.
105	M6	342	19.0	27.9	.200	.192	+
108	M9	420	22.0	25.0	.184		
106	M7	550	22.5	24.9	.239	.238	
100	M1	515	21.5	27.9	.237		
110	N2	360	19.5	23.6	.144	.137	−
113	N5	360	18.5	24.3	.130		
111	N3	420	19.0	25.3	.138	.133	
112	N4	430	19.5	25.6	.128		
117	O1	170	14.0	25.0	.106	.108	+
120	O4	230	16.0	28.7	.111		
124	O8	290	16.5	24.8	.121	.120	
123	O7	313	18.0	25.0	.118		
131	P7	435	20.5	26.8	.316	.314	−
130	P6	495	21.5	23.3	.311		
132	P8	740	23.5	26.8	.271	.291	
125	P1	735	24.5	26.1	.311		
134	Q1	55	9.5	24.2	.035	.046	+
140	Q7	61	10.0	25.0	.057		
135	Q2	68	10.5	23.8	.059	.054	
136	Q3	66	10.0	23.0	.048		
143	R2	693	25.5	27.5	.224	.251	+
146	R5	925	26.5	32.5	.270		
142	R1	1,098	27.0	33.3	.226	.257	
147	R6	1,035	28.5	31.6	.287		

Total result, 10 +, 8 −.

Note No. 1.—It will have been noticed that in the foregoing report nothing has been said concerning the percentage of thymi by length. An examination of the tables will show that there is indeed an increase in this percentage as larger and larger pigs are examined, but that this increase is neither marked nor uniform, and we must consider that part of the increase in weight must come by this increase in length. We feel that the method by which we secured the thymus lengths was not accurate and uniform enough to allow much value to be attached to the figures recorded. They may be taken as rather approximate. In general, the length of the thymus will average about 25 per cent of the total length of the pig. Suffice it to say, however, that we believe that as the fœti grow older and older there is an increase in the percentage of thymus by length; just how regular and consistent this increase is, we cannot say.

Note No. 2.—It is interesting to note that the pigs used for dissection showed a preponderance of males. This was probably purely accidental, however, and if larger numbers of animals had been used a more balanced ratio would have been secured.

CONCLUSIONS.

1. The thymus gland in the fœtal pig is comparatively very large, extending from a point above the upper half or third of the heart to the base of the mandible. In the thorax it consists of a single triangular body, but in the neck region is made up of paired branches which approximately parallel each other.

2. Sex appears to have no connection with the percentage of thymus found, except that possibly the values for the females may average a trifle higher than those for the males.

3. As larger and larger fœti, as regards both weight and length, are examined, the percentage of thymus by weight increases fairly steadily and rather uniformly.

4. Fœti tend to have the same size thymus as the average of pigs in their litter, regardless of individual size. No parallelism apparently exists between the small and large size, respectively, of underdeveloped and overdeveloped pigs, and the percentage of thymus by weight. Perhaps further work on this one question might bring a reversal of opinion, but the data obtained so far point to the statement made above.

5. Figures of percentage of thymus by length, while not very reliable, show that this percentage increases as larger and larger fœti are examined. Such increase, however, does not seem to be as uniform as that of the percentage by weight.

It is a pleasure to express here our appreciation of the help kindly given by Prof. W. J. Baumgartner in the preparation of this bit of work. It was at his suggestion that it was undertaken and by his guidance that it was carried out. Whatever of merit it has is due in large measure to him.

LITERATURE CITED.

1. Matti, H. 1913. Ergebnisse der Innere Med. u. Kinderheil., Bd. 10. (Quoted by Paton, D. Noel, in "The Nervous and Chemical Regulators of Metabolism": Macmillan & Co., Ltd., London: 1913; pp. 116-117.)

2. Basch, K. 1906-1908. Jahrbuch f. Kinderheil. (Quoted by Paton, D. Noel, in "The Nervous and Chemical Regulators of Metabolism": Macmillan & Co., Ltd., London: 1913; p. 114. Also by Biedl, Dr. Artur, in "The Internal Secretary Organs: Their Physiology and Pathology": Trans. by Linda Forster; London: John Bale Sons & Danielsson, Ltd., 1913; pp. 117-120.)

3. Badertscher, J. A. 1915. Development of the Thymus in the Pig. I: Morphogenesis. Am. Jour. Anat., vol. 17, No. 3, pp. 317-339.

4. Hatai, S. 1914. On the Weight of the Thymus Gland of the Albino Rat (*Mus norvegicus albinus*) According to Age. Am. Jour. Anat., vol. 16, No. 2, pp. 251-257.

5. HATAI, S. 1913. On the Weights of the Abdominal and Thoracic Viscera, the Sex Glands, Ductless Glands and the Eyeballs of the Albino Rat (*Mus norvegicus albinus*) According to Body Weight. Am. Jour. Anat., vol. 15, No. 1, pp. 69-87.

6. JACKSON, C. M. 1913. Postnatal Growth and Variability of the Body and of the Various Organs in the Albino Rat. Am. Jour. Anat., vol. 15, No. 1, pp. 1-69.

7. BADERTSCHER, J. A. 1915. Development of the Thymus in the Pig. II: Histogenesis. Am. Jour. Anat., vol. 17, No. 4, pp. 437-495.